3. TOOLBOX

This chapter of the NTCP summarizes the "toolbox" of devices that are available to the Placer County Department of Public Works and community members when developing neighborhood traffic calming plans. The "toolbox" contains 31 different devices that address neighborhood traffic related concerns such as speeding vehicles, high traffic volumes, cut-through traffic, or collisions at neighborhood intersections. The devices vary in their ability to treat various traffic related concerns. For this reason, Chapter 4, "Toolbox Guidelines," provides guidance on selecting the most appropriate devices given the type of specific traffic-related concern and street being treated.

The "toolbox" of neighborhood traffic management devices can be grouped into three categories:

- Non-Physical devices
- Speed Control
  - Narrowing devices
  - Horizontal devices
  - Vertical devices
- Volume Control devices

For each device in the "toolbox," the following information relating to each device is provided:

- Description of the measure
- Photograph and/or schematic
- List of advantages and disadvantages
- Data sheet indicating speed, volume, or collision reduction potential
- Estimated costs

Cost approximations are based on 2006 costs and are provided for information purposes only. Actual costs depend on many factors, including dimensions of device, construction materials, and actual construction costs.

NON-PHYSICAL DEVICES

Description

Non-physical devices include any measures that do not require physical changes to the roadway. Non-physical devices are intended to increase drivers' awareness of surroundings and influence driver behavior without physical obstructions. DPW staff will initially implement non-physical devices to treat traffic related concerns. However, these devices are not self enforcing and may have limited effectiveness as stand-alone devices. This category includes the following devices:

- Targeted Speed Enforcement
- Speed Radar Trailers
- Speed Feedback Sign
- Centerline/Edgeline Lane Striping
- Optical Speed Bars
- Signage
- Speed Legend
- Centerline Botts Dots
- High Visibility Crosswalks
- Angled Parking

Targeted Speed Enforcement

County Staff or NTC members can identify locations for temporary targeted enforcement, based on personal observations and survey comments. A request can be submitted to the California Highway Patrol (CHP) for the desired enforcement. Because of limited CHP resources, the duration of the targeted enforcement may be limited. Targeted enforcement may also be used in conjunction with new neighborhood traffic management devices to help drivers become aware of the new restrictions.

Approximate Cost: No direct cost.

Advantages

- Inexpensive if used temporarily
- Does not physically slow emergency vehicles or buses
- Quick implementation

Disadvantages

- Expensive to maintain an increased level of enforcement
- Effectiveness may be temporary

Radar Trailer

A radar trailer is a device that measures each approaching vehicle's speed and displays it next to the legal speed limit in clear view of the driver. They can be easily placed on a street for a limited amount of time then relocated to another street, allowing a single device to be effective in many locations.

Approximate Cost: No direct cost. (Purchase $6,000 - $12,000)

Advantages

- Portable
- Does not physically slow emergency vehicles or buses
- Quick implementation

Disadvantages

- Effectiveness may be temporary
- Drivers may divert to alternate streets due to uncertainty of device implications
- Subject to vandalism

Speed Feedback Signs

Speed feedback signs perform the same functions as radar trailers but are permanent. Real-time speeds are relayed to drivers and flash when speeds exceed the limit. Speed feedback signs are typically mounted on or near speed limit signs.

Approximate Cost: $3,000 - $10,000

Advantages

- Real-time speed feedback
- Does not physically slow emergency vehicles or buses
- Permanent installation

Disadvantages

- May require power source
- Only effective for one direction of travel
- Long-term effectiveness uncertain
- Subject to vandalism

Centerline/Edgeline Lane Striping

Lane striping can be used to create formal travel lanes, bicycle lanes, parking lanes, or edge lines. As a neighborhood traffic management measure, they are used to narrow the travel lanes for vehicles, thereby inducing drivers to lower their speeds. The past evidence on speed reductions is, however, inconclusive.

Approximate Cost: $2.00 per linear foot

Advantages

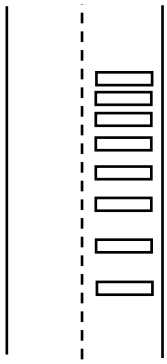
- Inexpensive
- Can be used to create bicycle lanes or delineate on-street parking
- Does not slow emergency vehicles

Disadvantages

- Has not been shown to significantly reduce travel speeds
- Requires regular maintenance

Optical Speed Bars

Optical speed bars are a series of pavement markings spaced at decreasing distances. They have typically been used in construction areas to provide drivers with the impression of increased speed. They do not provide long-term speed reduction benefits.



Advantages

- Inexpensive
- Does not physically slow emergency vehicles or buses

Disadvantages

- Long-term effects in residential area unknown
- Increases regular maintenance

Approximate Cost: $1.00 per linear foot

Signage

Various signs may also also be useful in alerting driver of certain conditions. Examples include:

- "Cross Traffic Does Not Stop" Signs
- Truck Restriction Signs

Approximate Cost: $150 - $500 per sign

Advantages

- Inexpensive
- Truck restrictions can reduce through truck traffic
- Does not slow emergency vehicles or buses

Disadvantages

- Requires regular maintenance
- Speed limit signs are not applicable because they do not necessarily change driver behavior
- If speed limits are set unreasonably low, drivers are more likely to exceed it

Speed Legend

Speed legends are numerals painted on the roadway indicating the current speed limit in miles per hour. They are usually placed near speed limit signposts. Speed legends can be useful in reinforcing a reduction in speed limit between one segment of a roadway and another segment. They may also be placed at major entry points into a residential area.

Approximate Cost: $75 per location

Advantages

- Inexpensive
- Helps reinforce a change in speed limit
- Does not slow emergency vehicles

Disadvantages

- Has not been shown to significantly reduce travel speeds
- Requires regular maintenance

Centerline Botts Dots

Botts dots, or "raised pavement markers," are small bumps lining the centerline or edgeline of a roadway. They are often used on curves where vehicles have a tendency to deviate outside of the proper lane, risking collision. Raised reflectors improve the nighttime visibility of the roadway edges.

Approximate Cost: $4.50 per marker

Advantages

- Inexpensive
- Does not physically slow emergency vehicles or buses
- Can help keep drivers in the appropriate travel lane on curves and under low-visibility conditions

Disadvantages

- Noise caused by Botts Dots
- Requires regular maintenance
- Has not been shown to significantly reduce travel speeds

High Visibility Crosswalks

High-visibility crosswalks use special marking patterns and raised reflectors to increase the visibility of a crosswalk. A "triple-four" marking pattern is created by painting two rows of four-foot wide rectangles, separated by four feet of unpainted space across the roadway. Raised reflectors are placed at the approach edges of these rectangles. The unpainted space along the center of the crosswalk provides an untreated path for wheelchair users and foot traffic, as markings may become slippery in rainy/wet conditions.

Advantages

- Increased visibility of crosswalk
- Focus crossing pedestrians at a single location

Disadvantages

- May give pedestrians a false sense of security, causing them to pay less attention to traffic
- Requires more maintenance than normal crosswalks

Approximate Cost: $1,600 per location

Angled Parking

Angled parking reorients on-street parking spaces to a 45-degree angle, increasing the number of parking spaces and reducing the width of the roadway available for travel lanes. Angled parking is also easier for vehicles to maneuver into and out of than parallel parking. Consequently, it works well in areas with high parking demand and turnover rates.

Approximate Cost: Dependent on amount of parking

Advantages

- Reduces speeds by narrowing the travel lanes
- Increases the number of parking spaces
- Provides for easier parking maneuvers that take less time than parallel parking
- Favored by businesses and multi-family residences

Disadvantages

- Precludes the use of bike lanes (unless roadway is wider than 58 feet)
- Ineffective on streets with frequent driveways
- Potential for collisions when backing out

SPEED CONTROL – NARROWING DEVICES

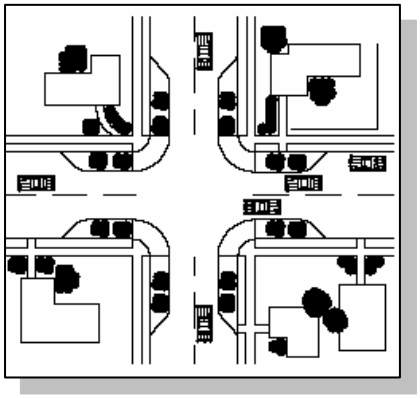
Description

Narrowing devices use raised islands and curb extensions to physically narrow the travel lane for motorists. The narrowing devices in the toolbox include:

- Neckdown/Bulbout
- Center Island Narrowing
- Two-Lane Choker
- One-Lane Choker

Neckdown/Bulbout

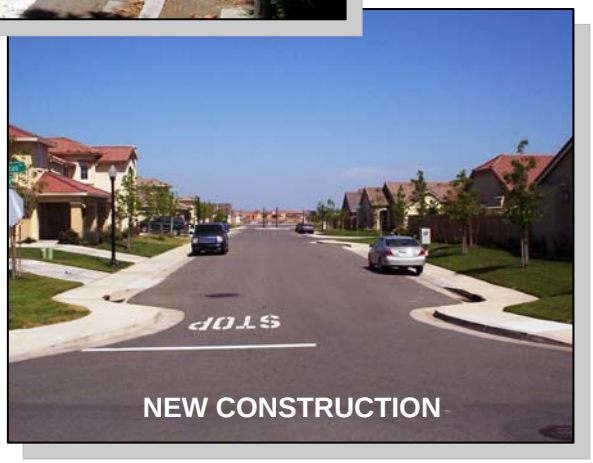
Neckdowns/bulbouts are raised curb extensions that narrow the travel lane at intersections or midblock locations. Neckdowns/bulbouts "pedestrianize" intersections by shortening the crossing distance and decreasing the curb radii, thus reducing turning vehicle speeds. Both of these effects increase pedestrian comfort and safety at the intersection.



The magnitude of speed reduction is dependent on the spacing of neckdowns between points that require drivers to slow (see page 55). On average, neckdowns achieve a 7 percent reduction in speeds.

Approximate Cost: $5,000 – $10,000 per corner

Measured Effectiveness		
Speed Reduction	Reduction in 85th Percentile Speeds between Slow Points	-7%
Volume Reduction	Reduction in Vehicles per Day	-10%
Safety Reduction	Reduction in Average Annual Number of Collisions	I/D
Note: I/D = Insufficient Data to predict reduction effect. Source: Traffic Calming: State of the Practice, 2000.		



Advantages

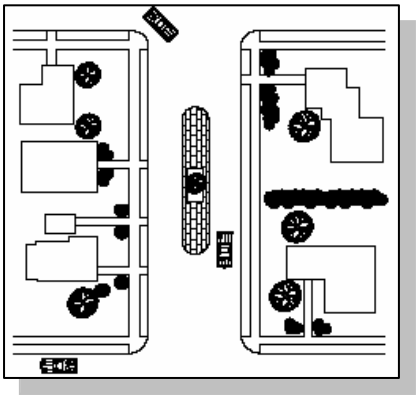
- Reduces pedestrian crossing distance and exposure to vehicles
- Through and left-turn movements are easily negotiable by large vehicles
- Creates protected on-street parking bays
- Reduces speeds (especially right-turning vehicles) and traffic volumes

Disadvantages

- Effectiveness is limited by the absence of vertical or horizontal deflection
- May slow right-turning emergency vehicles
- Potential loss of on-street parking
- May require bicyclists to briefly merge with vehicular traffic

Center Island Narrowing

Center island narrowings are raised islands located along the centerline of a street that narrow the travel lanes at that location. Placed at the entrance to a neighborhood, and often combined with textured pavement, they are often called "gateways." Fitted with a gap to allow pedestrians to walk through at a crosswalk, they are often called "pedestrian refuges." They can also be landscaped to increase visual aesthetics.



The magnitude of speed reduction is dependent on the spacing of center island narrowings between points that require drivers to slow (see page 55). On average, center island narrowings achieve a 7 percent reduction in speeds.

Approximate Cost: $5,000 - $10,000 per location

Measured Effectiveness		
Speed Reduction	Reduction in 85th Percentile Speeds between Slow Points	-7%
Volume Reduction	Reduction in Vehicles per Day	-10%
Safety Reduction	Reduction in Average Annual Number of Collisions	I/D
Note: I/D = Insufficient Data to predict reduction effect. Source: Traffic Calming: State of the Practice, 2000.		

FITTED WITH PEDESTRIAN REFUGE

UPGRADED AESTHETICS

Advantages

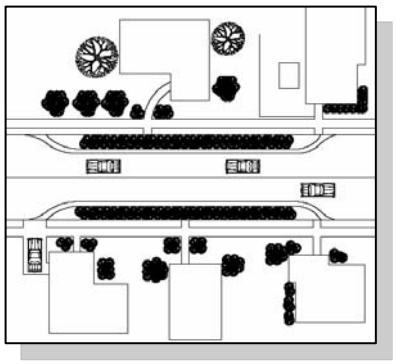
- Can increase pedestrian safety
- Aesthetic upgrades can have positive aesthetic value
- Reduces traffic volumes if alternative routes are available

Disadvantages

- Effect on vehicle speeds is limited by the absence of any vertical or horizontal deflection
- Potential loss of on-street parking

Two-lane choker

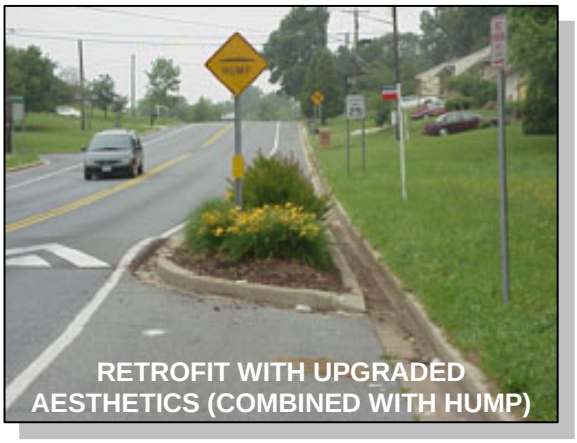
Chokers are curb extensions at midblock that narrow a street. Chokers leave the street cross section with two lanes that are narrower than the normal cross section.



The magnitude of speed reduction is dependent on the spacing of two-lane chokers between points that require drivers to slow (see page 55). On average two-lane chokers achieve a 7 percent reduction in speeds.

Approximate Cost: $7,000 - $8,000 per location

Measured Effectiveness		
Speed Reduction	Reduction in 85th Percentile Speeds between Slow Points	-7%
Volume Reduction	Reduction in Vehicles per Day	-10%
Safety Reduction	Reduction in Average Annual Number of Collisions	I/D
Note: I/D = Insufficient Data to predict reduction effect. Source: Traffic Calming: State of the Practice, 2000.		



RETROFIT WITH UPGRADED AESTHETICS (COMBINED WITH HUMP)

NEW CONSTRUCTION

Advantages

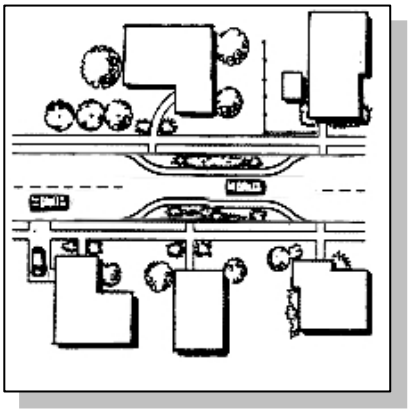
- Easily negotiable by emergency vehicles and buses
- Can have positive aesthetic value
- Reduces both speeds and volumes

Disadvantages

- Effect on vehicle speeds is limited by the absence of any vertical or horizontal deflection
- May require bicyclists to briefly merge with vehicular traffic
- Loss of on-street parking
- Build-up of debris in gutter

One-lane choker

One-lane chokers narrow the roadway width such that there is only enough width to allow travel in one direction at a time. They operate similarly to one-lane bridges, where cars approaching on one side must wait until all traffic in the other direction has cleared before proceeding.



The magnitude of speed reduction is dependent on the spacing of one-lane chokers between points that require drivers to slow (see page 55). On average, one-lane chokers achieve a 14 percent reduction in speeds.

Approximate Cost: $8,000 - $9,000 per location

Measured Effectiveness		
Speed Reduction	Reduction in 85th Percentile Speeds between Slow Points	-14%
Volume Reduction	Reduction in Vehicles per Day	-20%
Safety Reduction	Reduction in Average Annual Number of Collisions	I/D
Note: I/D = Insufficient Data to predict reduction effect. Source: Traffic Calming: State of the Practice, 2000.		

Advantages

- Maintains two-way vehicle access, except at choker
- Very effective in reducing speeds and traffic volumes

Disadvantages

- Perceived as unsafe because opposing traffic is vying for space in a single lane
- Can be used only on low-volume, low speed roads
- Loss of on-street parking

SPEED CONTROL – HORIZONTAL DEVICES

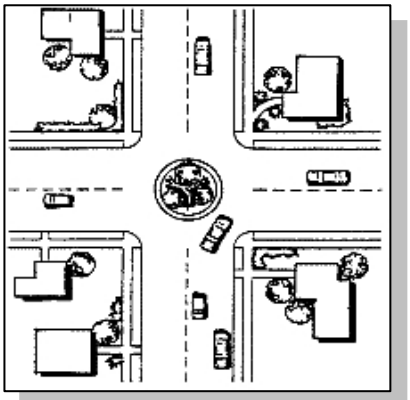
Description

Horizontal deflection devices use raised islands and curb extensions to physically eliminate straight-line paths along roadways and through intersections. The horizontal deflection devices in the toolbox include:

- Traffic Circle
- Roundabout (Single-Lane)
- Chicane
- Lateral Shift
- Realigned Intersection

Traffic Circle

Traffic circles are raised islands, placed in intersections, around which traffic circulates. Stop signs or yield signs can be used as traffic controls at the approaches of the traffic circle. Circles prevent drivers from speeding through intersections by impeding the straight-through movement and forcing drivers to slow down to yield. Depending upon the size of the intersection and circle, trucks may be permitted to turn left in front of the circle.



The magnitude of speed reduction is dependent on the spacing of traffic circles between points that require drivers to slow (see page 55). On average, traffic circles achieve an 11 percent reduction in speeds and a dramatic 71 percent decrease in collisions.

Approximate Cost: $10,000 - $25,000 per location

Measured Effectiveness		
Speed Impacts	Reduction in 85th Percentile Speeds between Slow Points	-11%
Volume Impacts	Reduction in Vehicles per Day	-5%
Safety Impacts	Reduction in Average Annual Number of Collisions	-71%
Source: Traffic Calming: State of the Practice, 2000.		

Advantages

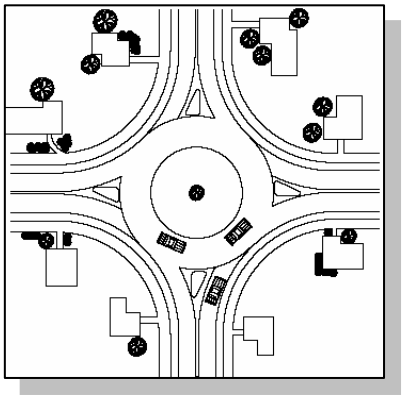
- Very effective in moderating speeds and improving safety
- Can have positive aesthetic value

Disadvantages

- If not designed properly, difficult for emergency vehicles or large trucks to travel around
- Must be designed so that the circulating traffic does not encroach on crosswalks
- Potential loss of on-street parking

Roundabout (single-lane)

Like traffic circles, roundabouts require traffic to circulate counterclockwise around a center island. But unlike circles, roundabouts are used on higher volume streets to allocate right-of-way among competing movements. They are found primarily on collector streets, often substituting for traffic signals. They are larger than neighborhood traffic circles, have raised splitter islands to channel approaching traffic to the right, and do not have stop signs. Due to large amount of required right-of-way and construction costs, roundabouts may be most appropriate for new developments.



Roundabouts have an insignificant effect in reducing traffic speeds, but serve to allocate right-of-way at an intersection similar to a traffic signal. On average, roundabouts can reduce the average number of accidents up to 33 percent when compared to a signalized intersection.

Approximate Cost: Varies by intersection and whether new construction or a retrofit.

Measured Effectiveness		
Speed Impacts	Reduction in 85th Percentile Speeds between Slow Points	I/D
Volume Impacts	Reduction in Vehicles per Day	I/D
Safety Impacts	Reduction in Average Annual Number of Collisions	-15% to -33%
Note: I/D = Insufficient Data to predict reduction effect. Source: Roundabouts: An Informational Guide, 2000.		

Advantages

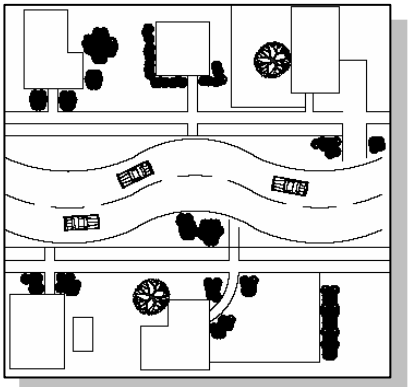
- Enhanced vehicle safety compared to a traffic signal or stop sign
- Minimizes queuing at approaches to the intersection
- Less expensive to operate than traffic signals
- Can have positive aesthetic value
- Shorter pedestrian crossing distance

Disadvantages

- May require major reconstruction of an existing intersection
- Loss of on-street parking
- Continuous flow of traffic limits opportunity for pedestrians to cross (compared to signal)

Chicane

Chicanes are curb extensions that alternate from one side of the street to the other, forming S-shaped curves. Chicanes can also be created by alternating on-street parking between one side of the road and the other. Each parking bay can be created either by restriping the roadway or by installing raised center islands at each end, creating a protected parking area. Chicanes have limited effectiveness in reducing traffic speeds and volumes as compared to other devices. Little data has been collected to predict the reduction in speed, traffic volumes, or collisions, and use of this device may not result in significant decreases. Resources permitting, DPW staff can collect before and after data to determine the effectiveness of chicanes.



Approximate Cost: $8,000 - $14,000 per location

Measured Effectiveness		
Speed Impacts	Reduction in 85th Percentile Speeds between Slow Points	I/D
Volume Impacts	Reduction in Vehicles per Day	I/D
Safety Impacts	Reduction in Average Annual Number of Collisions	I/D
Note: I/D = Insufficient data to predict reduction effect.		

Advantages

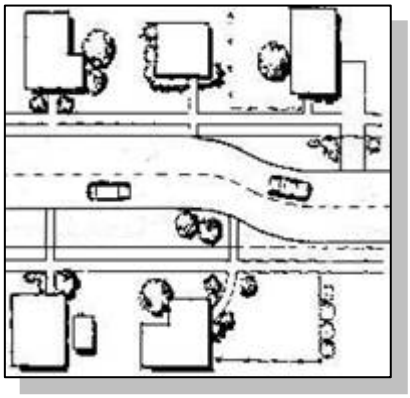
- Discourages high speeds by forcing horizontal deflection
- Easily negotiable by emergency vehicles and buses

Disadvantages

- Must be designed carefully to discourage drivers from deviating out of the appropriate lane
- Curb realignment and landscaping can be costly, especially if there are drainage issues
- Loss of on-street parking

Lateral Shift

Lateral shifts are curb extensions on otherwise straight streets that cause a shift in the travel. Lateral shifts, with just the right degree of deflection, can be effective. However, lateral shifts have had limited use in the United States, and, consequently, insufficient data prevents accurate prediction of speed reduction and traffic volumes.



Approximate Cost: Dependent on size of offset and length of transition

Measured Effectiveness		
Speed Reduction	Reduction in 85th Percentile Speeds between Slow Points	I/D
Volume Reduction	Reduction in Vehicles per Day	I/D
Safety Reduction	Reduction in Average Annual Number of Collisions	I/D
Note: I/D = Insufficient Data to predict reduction effect.		

Advantages

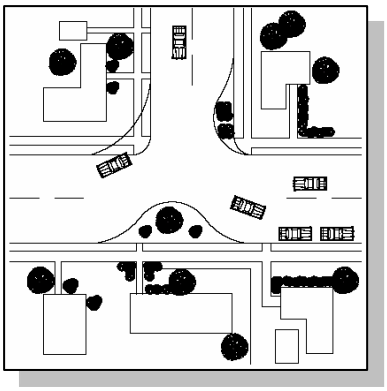
- Can accommodate higher traffic volumes than many other neighborhood traffic management measures
- Easily negotiable by large emergency vehicles and buses

Disadvantages

- Potential for loss of on-street parking
- Must be designed carefully to discourage drivers from deviating out of the appropriate lane

Realigned Intersection

Realigned intersections provide deflection on an otherwise straight approach of a T-intersection. By providing deflection in the form of a curb extension or realignment, drivers are required to slow through the intersection or come to a stop before turning. Little data has been collected to predict the reduction in speed, traffic volumes, or collisions, and use of this device may not result in significant decreases. Resources permitting, DPW staff can collect before and after data to determine the effectiveness of realigned intersections.



Approximate Cost: $15,000 - $30,000 per location

Measured Effectiveness		
Speed Reduction	Reduction in 85th Percentile Speeds between Slow Points	I/D
Volume Reduction	Reduction in Vehicles per Day	I/D
Safety Reduction	Reduction in Average Annual Number of Collisions	I/D
Note: I/D = Insufficient Data to predict reduction effect.		

Advantages

- Can be effective at reducing speeds at T-intersections
- Can be effective in increasing safety at T-intersections

Disadvantages

- Modifying curbs or drainage can be costly
- Acquiring additional right-of-way can be costly

SPEED CONTROL – VERTICAL DEVICES

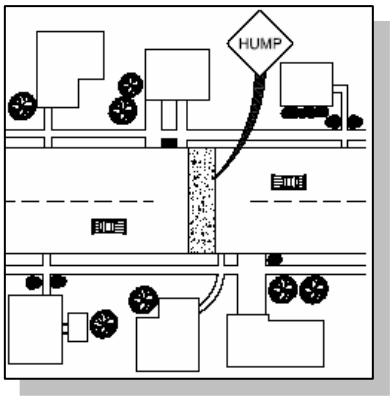
Description

Vertical deflection devices use variations in pavement height and alternative paving materials to physically reduce travel speeds. The design speeds for these devices are approximately 15 to 20 mph depending on the device. The vertical deflection devices in the toolbox include:

- Speed Hump
- Speed Lump
- Speed Cushion
- Speed Table
- Raised Crosswalk
- Rumble Strip
- Raised Intersection
- Textured Pavement

Speed Hump

Speed humps are rounded raised areas placed across the road. They are generally 12 feet long (in the direction of travel), 3 to 3 ½ inches high, parabolic in shape, and have a design speed of 15 to 20 mph. They are usually constructed with a taper on each side to allow unimpeded drainage between the hump and curb. When placed on a street with rolled curbs or no curbs, bollards are placed at the ends of the speed hump to discourage vehicles from veering outside of the travel lane to avoid the device.



The magnitude of reduction in speed is dependent on the spacing of speed humps between points that require drivers to slow (see page 55). On average, speed humps achieve a 22 percent reduction in speeds.

Approximate Cost: $2,000 - $3,000 per location

Measured Effectiveness		
Speed Impacts	Reduction in 85th Percentile Speeds between Slow Points	-22%
Volume Impacts	Reduction in Average Daily Traffic	-18%
Safety Impacts	Reduction in Average Annual Number of Collisions	-13%
Source: Traffic Calming: State of the Practice, 2000.		

Advantages

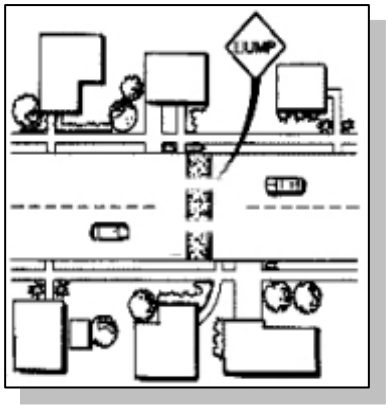
- Relatively inexpensive
- Relatively easy for bicyclists to cross
- Very effective in slowing travel speeds

Disadvantages

- Causes a “rough ride” for drivers, and can discomfort people with certain skeletal disabilities
- Slows emergency vehicles and buses
- Aesthetics
- Signs may be unwelcome by adjacent residents
- Increased noise for nearby residents

Speed Lump

The speed lump is a variation on the speed hump, adding two wheel cut-outs designed to allow large vehicles, such as emergency vehicles and buses, to pass with minimal slowing. The design limits passenger cars and mid-size SUVs from fully passing through the cut-outs, but allows one set of wheels to pass through the cut-out while the other set is required to travel over the lump.



The magnitude of speed reduction is dependent on the spacing of speed lumps between points that require drivers to slow (see page 55). Speed lumps have a similar reduction in speeds when compared to speed humps.

Approximate Cost: $2,000 - $3,000 per location

Measured Effectiveness		
Speed Reduction	Reduction in 85th Percentile Speeds between Slow Points	I/D, but comparable to speed humps
Volume Reduction	Reduction in Average Daily Traffic	
Safety Reduction	Reduction in Average Annual Number of Collisions	
Note: I/D = Insufficient Data to predict reduction effect.		

Advantages

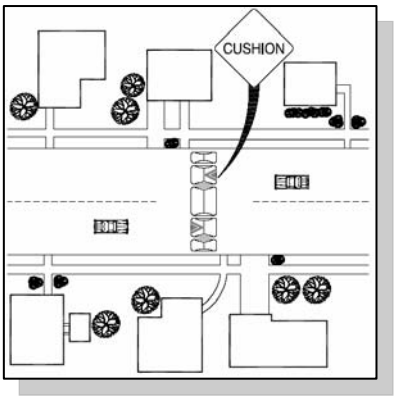
- Effective in reducing speeds
- Maintains rapid emergency response times
- Relatively easy for bicyclists to cross

Disadvantages

- Passenger vehicles with wide wheel base can pass through the lump using the wheel cut-outs
- Aesthetics
- Signs may be unwelcome by adjacent residents
- Increased noise for nearby residents

Speed Cushion

Speed cushions are a variation of the speed lump that is constructed from durable recycled rubber. These prefabricated devices consistently have a more uniform shape than asphalt humps. Speed cushions provide wheel gaps for emergency vehicles and buses, and can be arranged to fit any street width.



The magnitude of speed reduction is dependent on the spacing of speed cushions between points that require drivers to slow (see page 55). On average, speed cushions achieve a 14 percent reduction in speeds.

Approximate Cost: $4,500 - $6,000 per location

Measured Effectiveness		
Speed Reduction	Reduction in 85th Percentile Speeds between Slow Points	-14%
Volume Reduction	Reduction in Average Daily Traffic	Comparable to Speed Lumps
Safety Reduction	Reduction in Average Annual Number of Collisions	
Source: City of Portland, Rubber Speed Bump Research, 1995.		

Advantages

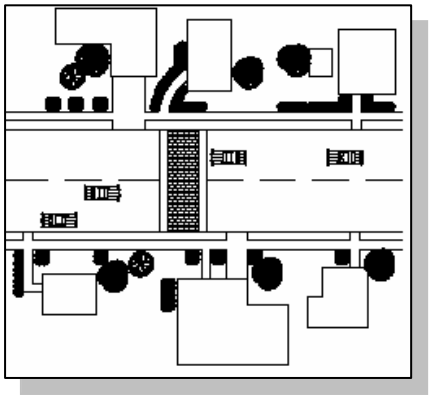
- Provides a more consistent ride than asphalt humps
- Can be used as a temporary device during a testing phase
- Reduces impacts to emergency vehicles due to cut-outs
- Easily accommodates street resurfacing

Disadvantages

- Aesthetics (but may be better than lumps)
- Signs may be unwelcome by adjacent residents
- Increased noise for nearby residents

Speed Table

Speed tables are flat-topped speed humps approximately 22 feet long. They are typically long enough for the entire wheelbase of a passenger car to rest on top. Their long, flat fields, plus ramps that are more gently sloped than speed humps, give speed tables higher design speeds than humps, and, thus, may be more appropriate for streets with higher ambient speeds. Brick or other textured materials improve the appearance of speed tables, draw attention to them, and may enhance safety and speed reduction.



The magnitude of speed reduction is dependent on the spacing of speed tables between points that require drivers to slow (see page 55). On average, speed tables achieve an 18 percent reduction in speeds.

Approximate Cost: $4,000 for basic treatment

Measured Effectiveness		
Speed Impacts	Reduction in 85th Percentile Speeds between Slow Points	-18%
Volume Impacts	Reduction in Vehicles per Day	-12%
Safety Impacts	Reduction in Average Annual Number of Collisions	-45%
Source: Traffic Calming: State of the Practice, 2000.		

STANDARD TREATMENT

UPGRADED AESTHETICS

Advantages

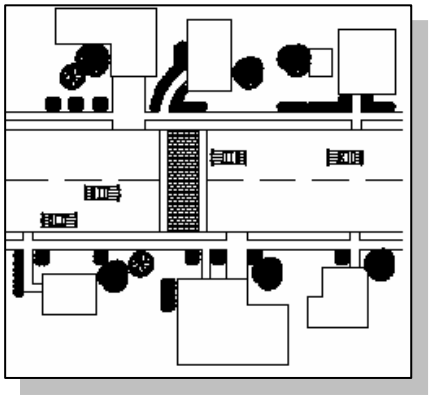
- Smoother on large vehicles (such as fire trucks) than speed humps
- Effective in reducing speeds, though not to the extent of speed humps

Disadvantages

- Aesthetics
- Textured materials, if used, can be expensive
- Signs may be unwelcome by adjacent residents
- Increased noise for nearby residents

Raised Crosswalk

Raised crosswalks are speed tables striped with crosswalk markings and signage to channelize pedestrian crossings, providing pedestrians with a level street crossing. Also, by raising the level of the crossing, pedestrians are more visible to approaching motorists.



The magnitude of speed reduction is dependent on the spacing of raised crosswalks between points that require drivers to slow (see page 55). On average, raised crosswalks achieve an 18 percent reduction in speeds.

Approximate Cost: $5,000 for basic treatment

Measured Effectiveness		
Speed Impacts	Reduction in 85th Percentile Speeds between Slow Points	-18%
Volume Impacts	Reduction in Vehicles per Day	-12%
Safety Impacts	Reduction in Average Annual Number of Collisions	-45%
Source: Traffic Calming: State of the Practice, 2000.		

Advantages

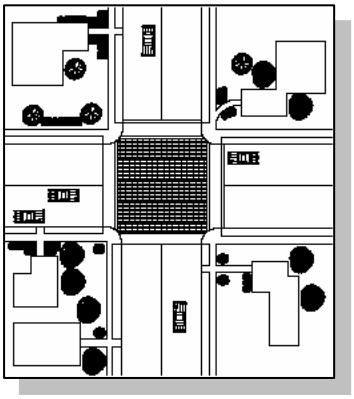
- Improve safety for both vehicles and pedestrians
- Aesthetic upgrades can have positive aesthetic value
- Effective in reducing speeds, though not to the extent of speed humps

Disadvantages

- Textured materials, if used, can be expensive
- Impact to drainage needs to be considered
- Textured pavement can increase noise to adjacent residents
- Signs may be unwelcome by adjacent residents

Raised Intersection

Raised intersections are flat raised areas covering entire intersections, with ramps on all approaches. They usually rise to sidewalk level, or slightly below, to provide a "lip" for the visually impaired. By modifying the level of the intersection, the crosswalks are more readily perceived by motorists to be a pedestrian area. They are particularly useful where loss of on-street parking due to other traffic calming devices is considered unacceptable. Raised intersections are ineffective at reducing traffic speeds or volumes.



Approximate Cost: Varies based on size of intersection

Measured Effectiveness		
Speed Reduction	Reduction in 85th Percentile Speeds between Slow Points	-1%
Volume Reduction	Reduction in Average Daily Traffic	I/D
Safety Reduction	Reduction in Average Annual Number of Collisions	I/D
Note: I/D = Insufficient Data to predict reduction effect. Source: Traffic Calming: State of the Practice, 2000.		

Advantages

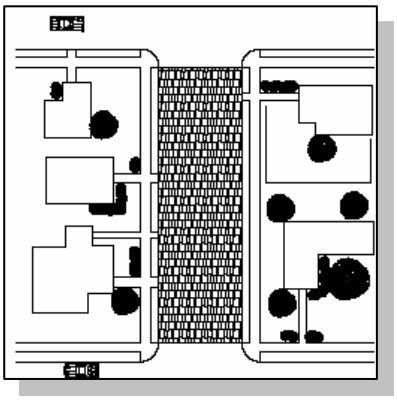
- Can improve safety for pedestrians and motorists
- Aesthetic upgrades can have positive aesthetic value
- Can treat two streets at once

Disadvantages

- Less effective in reducing vehicle speeds than speed humps and speed tables
- Expensive, particularly as a retrofit
- Textured pavement can increase noise to adjacent residents

Textured Pavement

Textured colored pavement includes the use of stamped pavement (asphalt) or alternate paving materials to create an uneven surface for vehicles to traverse. Textured pavement may have limited effectiveness as a standalone device and should be used to supplement other devices such as raised crosswalks or center median islands. Little data has been collected to predict the reduction in speed, traffic volumes, or collisions, and use of this device may not result in significant decreases. Resources permitting, DPW staff can collect before and after data to determine the effectiveness of textured pavement.



Approximate Cost: $8.00 per square foot

Measured Effectiveness		
Speed Reduction	Reduction in 85th Percentile Speeds between Slow Points	I/D
Volume Reduction	Reduction in Average Daily Traffic	I/D
Safety Reduction	Reduction in Average Annual Number of Collisions	I/D
Note: I/D = Insufficient Data to predict reduction effect.		

Advantages

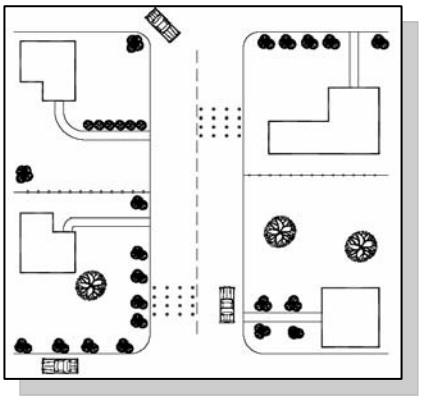
- Can reduce vehicle speeds
- Aesthetic upgrades can have positive value
- Placed at an intersection, it can slow two streets at once

Disadvantages

- Expensive, varying by materials used
- Can be uncomfortable for bicyclists or handicapped.
- Textured pavement can increase noise to adjacent properties

Rumble Strip

Rumble strips are closely spaced raised pavement markers at regular intervals on the roadway that create noise and vibration to the vehicle. Rumble strips can be used to warn drivers of a change in speed limit, leading up to a residential or school area, and upcoming stop sign or intersection. Rumble strips should be used only in areas where the noise impact would be minimal. Little data has been collected to predict the reduction in speed, traffic volumes, or collisions, and use of this device may not result in significant decreases. Resources permitting, DPW staff can collect before and after data to determine the effectiveness of rumble strips.



Approximate Cost: $500 per location

Measured Effectiveness		
Speed Reduction	Reduction in 85th Percentile Speeds between Slow Points	I/D
Volume Reduction	Reduction in Average Daily Traffic	I/D
Safety Reduction	Reduction in Average Annual Number of Collisions	I/D
Note: I/D = Insufficient Data to predict reduction effect.		

Advantages

- Relatively inexpensive
- Can be effective in slowing travel speeds in specific locations

Disadvantages

- Raised pavement markers can be slippery when wet
- Increased noise in vicinity of rumble strips
- Maintenance of raised pavement markers
- Aesthetics
- Uncomfortable for motorcyclists and bicyclists

VOLUME CONTROL – DEVICES

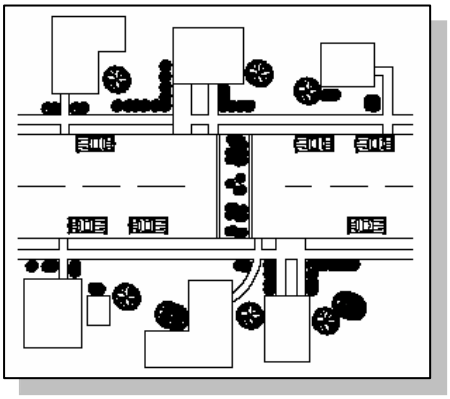
Description

Diversion devices use raised islands and curb extensions to physically preclude particular vehicle movements, such as left-turn or through movements, usually at an intersection. These devices can be considered only after all other devices have been attempted and failed to resolve the traffic problem. The diversion devices in the toolbox include:

- Full Closure
- Partial Closure
- Diagonal Diverter
- Median Barrier
- Forced Turn Island
- Turn-Movement Restriction

Full Closure

Full street closures are barriers placed across a street to close the street completely to through traffic, usually leaving only sidewalks or bicycle paths open. The barriers may consist of landscaped islands, walls, gates, side-by-side bollards, or any other obstructions that leave an opening smaller than the width of a passenger car. Emergency vehicles can be accommodated via removable bollards or similar devices.



Approximate Cost: $30,000 - $100,000 per location (dependent on size and treatment)

Measured Effectiveness		
Speed Reduction	Reduction in 85th Percentile Speeds between Slow Points	I/D
Volume Reduction	Reduction in Vehicles per Day	-44%
Safety Reduction	Reduction in Average Annual Number of Collisions	I/D
Note: I/D = Insufficient Data to predict reduction effect. Source: Traffic Calming: State of the Practice, 2000.		

Advantages

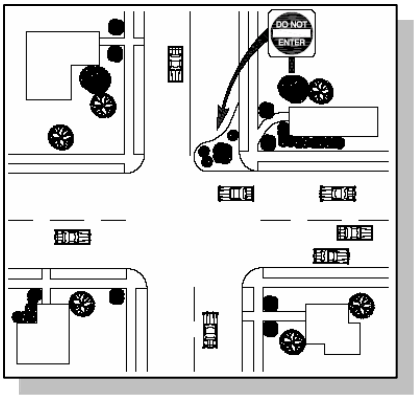
- Very effective in reducing cut-through traffic volumes
- Able to maintain pedestrian and bicycle connectivity

Disadvantages

- Requires statutory actions for public street closures
- Causes circuitous routes for local residents
- Diverts traffic to another street
- Delays for emergency services unless through access is provided
- May limit access to businesses
- Cost

Partial Closure

Half street closures are barriers that block travel in one direction for a short distance on otherwise two-way streets. Half closures are the most common volume control measure after full street closures. Half closures are often used in sets to make travel through neighborhoods with a grid street pattern circuitous rather than direct.



Approximate Cost: $5,000 - $7,000 per location

Measured Effectiveness		
Speed Reduction	Reduction in 85th Percentile Speeds between Slow Points	-19%
Volume Reduction	Reduction in Vehicles per Day	-42%
Safety Reduction	Reduction in Average Annual Number of Collisions	I/D
Note: I/D = Insufficient Data to predict reduction effect. Source: Traffic Calming: State of the Practice, 2000.		

Advantages

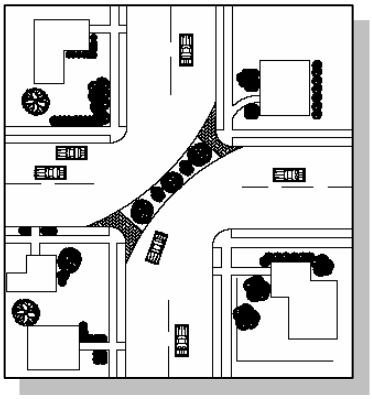
- Able to maintain two-way bicycle access
- Effective in reducing traffic volumes

Disadvantages

- Causes circuitous routes for local residents
- May limit access to businesses
- Drivers can bypass the barrier

Diagonal Diverter

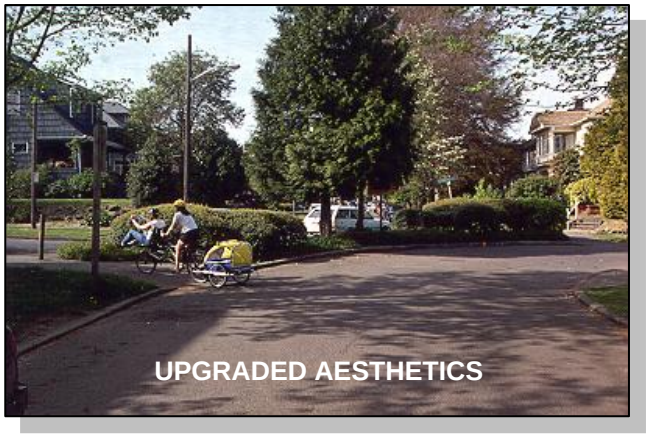
Diagonal diverters are barriers placed diagonally across an intersection, blocking through movement. Like half closures, diagonal diverters are usually staggered to create circuitous routes through neighborhoods.



Approximate Cost: $20,000 - $25,000 per location

Measured Effectiveness		
Speed Reduction	Reduction in 85th Percentile Speeds between Slow Points	-4%
Volume Reduction	Reduction in Vehicles per Day	-35%
Safety Reduction	Reduction in Average Annual Number of Collisions	I/D
Note: I/D = Insufficient Data to predict reduction effect. Source: Traffic Calming: State of the Practice, 2000.		

STANDARD TREATMENT
WITH MINOR LANDSCAPING TREATMENT



UPGRADED AESTHETICS

Advantages

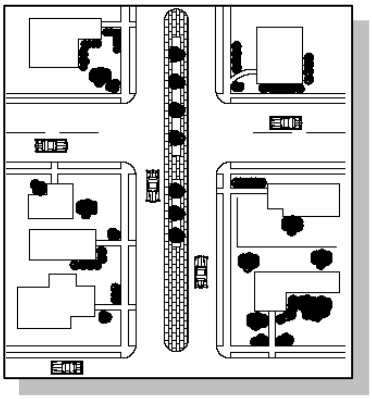
- Able to maintain full pedestrian and bicycle access
- Reduces traffic volumes

Disadvantages

- Causes circuitous routes for local residents
- Delays for emergency services
- May be expensive
- May require reconstruction of corner curbs

Median Barrier

Median barriers are raised islands that are located along the centerline of a street and continue through an intersection so as to block through (and left-turn) movement at a cross street.



Approximate Cost: $15,000 - $20,000 per 100 feet (dependent on length and width)

Measured Effectiveness		
Speed Reduction	Reduction in 85th Percentile Speeds between Slow Points	I/D%
Volume Reduction	Reduction in Vehicles per Day	-31%
Safety Reduction	Reduction in Average Annual Number of Collisions	I/D
Note: I/D = Insufficient Data to predict reduction effect. Source: Traffic Calming: State of the Practice, 2000.		

STANDARD TREATMENT


UPGRADED AESTHETICS

Advantages

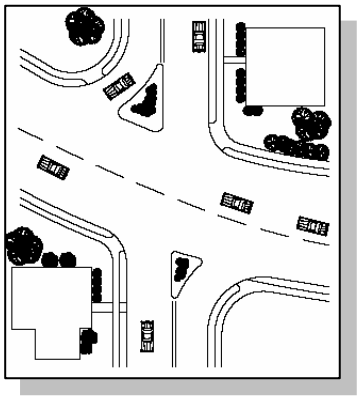
- Can improve safety at an intersection of a local street and a major street by prohibiting critical through or left-turn movements
- Can reduce traffic volumes on a cut-through route that crosses a major street

Disadvantages

- Requires available street width on the major street
- Limits turns to and from the side streets and driveways for local residents and emergency services

Forced-Turn Island

Forced turn islands are raised islands that prohibit certain movements on approaches to an intersection.



Approximate Cost: $3,000 - $5,000 per location

Measured Effectiveness		
Speed Reduction	Reduction in 85th Percentile Speeds between Slow Points	I/D%
Volume Reduction	Reduction in Vehicles per Day	-31%
Safety Reduction	Reduction in Average Annual Number of Collisions	I/D
Note: I/D = Insufficient Data to predict reduction effect. Source: Traffic Calming: State of the Practice, 2000.		

Advantages

- Can improve safety at an intersection by prohibiting critical turning movements
- Reduces traffic volumes

Disadvantages

- If designed improperly, drivers can maneuver around the island to make an illegal movement
- May divert a traffic problem to a different street

Turn-Movement Restrictions

Turn movement restrictions involve the use of signs to prevent undesired turning movements without the use of physical devices. The restrictions may generally apply to turning movements in or out of a residential street to a larger street. The turn movement restrictions may be permanent or only during peak commute hours.

Measured Effectiveness		
Speed Reduction	Reduction in 85th Percentile Speeds between Slow Points	I/D
Volume Reduction	Reduction in Vehicles per Day	I/D
Safety Reduction	Reduction in Average Annual Number of Collisions	I/D
Note: I/D = Insufficient Data to predict reduction effect.		

Approximate Cost: $150 per sign (enforcement may be necessary to be effective)

Advantages

- Can reduce cut-through traffic at specific times of day
- Can increase safety at an intersection by prohibiting certain turning movements
- Low cost

Disadvantages

- Restrictions apply to resident and non-residents
- Requires enforcement during time of restriction to be effective
- May divert a traffic problem to another street